

*IMPORTANT NOTICE: A printed copy of this document may not be the version currently in effect. The current official version is via the Sandia National Laboratories Nuclear Waste Management Online Documents web site.*

**SANDIA NATIONAL LABORATORIES**  
**YUCCA MOUNTAIN SITE CHARACTERIZATION PROJECT**  
**TECHNICAL PROCEDURE**

**TP-236**

**Tape Extensometer Measurements**

**Revision 02**

Author: Original Signed By Ron Taylor Date: 01/30/97  
Ron Taylor, Principal Investigator

Approved: Original Signed By Clinton Lum Date: 01/30/97  
Independent Technical Review

Approved: Original Signed By John F. Pelletier Date: 01/31/97  
SNL YMP Quality Assurance Review

Approved: Original Signed By Jeffrey J. Danneels Date: 01/31/97  
J. J. Danneels, 6853  
SNL YMP Manager

Effective Date: 01/31/97

## REVISION HISTORY

<u>Revision</u>	<u>Effective Date</u>	<u>Summary</u>
00	8/7/95	Initial issue under title “Operation, Calibration, and Control of Tape Extensometers”
01	1/17/96	Complete rewrite to better represent process, focus on necessary steps, and improve documentation flow. Replaces former use of scientific notebook with records generated by this procedure, narrows scope to the measurement process, and clarifies baseline determination
02		Modified Section 4.2.3 to reflect current post-processing steps, updated Section 5.0 (Records) to identify records as lifetime records per YM-96-D-088.

## **1.0 SCOPE**

This Technical Procedure applies to all SNL YMP personnel and contractors performing tape extensometer measurements in the Exploratory Studies Facility (ESF).

## **2.0 OBJECTIVES AND PRIMARY TASKS**

The objective of this technical procedure is to describe the process for performing and documenting tape extensometer measurements in the ESF. The measurement process is based on ASTM D4403-84, "Standard Practice for Extensometers Used in Rock," and the Geokon Tape Extensometer Instruction Manual provided with the instrumentation. The process includes two primary tasks: (1) Setting Tape Extensometer Performance Criteria; and (2) Performing Tape Extensometer Measurements

## **3.0 PREREQUISITES**

The Principal Investigator is responsible for assuring that individuals assigned to conduct tape extensometer measurements under this procedure are trained before these individuals initiate work. This training includes documenting that these individuals have read the procedure and have demonstrated proficiency in its use.

Other prerequisites to the execution of this procedure, which are the responsibility of the individual making measurements, are ensuring that:

- a controlled copy of the procedure is available for use; and
- only controlled, calibrated instrumentation is used.

## **4.0 PROCESS**

### **4.1 Setting Tape Extensometer Performance Criteria**

#### **4.1.1 Baseline Average Uncertainty:**

Perform and record a series of at least ten measurements of a calibrated static frame with each tape extensometer to establish an average uncertainty range for the instrument. (It is preferable, however, to have three or more individuals each perform a series of at least ten measurements each to minimize potential operator bias.) The Baseline Average Uncertainty range is set to the average plus or minus two standard deviations for all readings in this series. The baseline range is used to check instrument performance both before and after a series of readings in the ESF. New baseline values are established at least annually, whenever the instrument configuration changes, or whenever the performance check measurements are found to exceed the existing baseline values. Documentation of this step includes identification of the static frame, extensometer gage, and digital thermometer, extensometer tape and gage readings, temperature, dated signature of the individual making the measurements, and calculation results.

#### **4.1.2 Relative Instrument Baseline**

Because different tape extensometers will not produce identical absolute measurements, a baseline value of the relative measurement difference between instruments is needed. This permits the use of alternate instruments in case of failure of an original. The baseline relative measurement value is determined by averaging a series of similar

measurements made with both instruments at several measurement stations in the ESF. The Relative Instrument Baseline value is set to the average of the temperature-corrected length differences between measurements made with two different extensometer gages. This process is repeated whenever new instruments are acquired or whenever the instrument configuration changes. Documentation of this step includes the usual measurement documentation (See Section 4.2) and calculation results.

## 4.2 Performing Tape Extensometer Measurements

### 4.2.1 Performance Checking

Both before and after taking ESF extensometer readings:

Examine the extensometer for any visible damage since its last use.

Conduct performance checks by using the calibrated extensometer to measure a standard, calibration frame.

Compare the measurements against the Baseline Average Uncertainty range.

- If the measurements are within the baseline range, the instrument is assumed usable.
- If the measurements fall outside the baseline range,
  - repeat the measurement and comparison after the extensometer and calibration frame reach thermal equilibrium (at least fifteen minutes).
  - If the measurement remains outside the baseline range, do not use the extensometer; notify the Principal Investigator, who determines if the baseline range should be updated (See Section 4.1.1) or other equipment calibration and control steps taken per QAIP 12-1.

### 4.2.2 Conducting a Tape Extensometer Measurement

1. For safety reasons, tape extensometer measurements to the left rib of the ESF require that the conveyor belt be locked out and tagged by the ESF Test Coordination Office during the measurement. Contact the ESF Test Coordination Office to arrange the lockout period. It is recommended that a two-person team perform tape extensometer measurements in the ESF.
2. Connect the two ends of the extensometer to the convergence pins.
3. Take up the slack in the tape and engage the tape locking pin in the nearest punched tape hole.
4. Align the extensometer along the chord between the two convergence pins, minimizing the effect of instrument weight on tape tension.
5. Align the scribed lines on the instrument, repeating the previous step if necessary to adjust the tape locking point.
6. Check the tape alignment.
7. Record the date, time, temperature (to 0.1°F), measurement location (station and chord), instrument readings (foot, inch, and vernier {to the nearest 0.001"}), and instrument identification (dial gage and digital thermometer), and comments (if any). Initial and date this documentation.

8. If the measurement appears to deviate significantly from earlier readings, the measurement should be repeated to determine if it is reproducible. If not, the measurement should be repeated with another extensometer.

#### 4.2.3 Post-processing and archival of extensometer data.

Submit original records of extensometer measurement data in a timely manner for retention in the records package associated with the Work Agreement under which this procedure is conducted.

[Note: Post-processing of the data, either by hand calculation or database functions includes the following:

- Conversion of readings into a common unit system
- Correction of lengths for thermal expansion of the extensometer tape
- Calculation of displacement (as the difference between measurements taken between the same convergence pins) and displacement rate, corrected for relative instrument differences if appropriate.]

### 5.0 RECORDS

Records and record packages, including corrections and changes thereto, generated as a result of implementing this procedure shall be prepared and submitted as lifetime QA records (QA:L) to the SNL Local Records Receiving Organization by the record source in accordance with the requirements of QAIP 17-1.

QA records generated by this procedure include:

- Documentation of proficiency in the use of this procedure;
- Records of measurements and calculations used to establish tape extensometer performance criteria;
- Records of ESF data collection, including pre- and post-measurement performance checks; and
- Records of any data processing and conversion.

### 6.0 REFERENCES

1. ASTM D4403-84, "Standard Practice for Extensometers Used in Rock," American Society for Testing and Materials, November, 1984.
2. Geokon Tape Extensometer Instruction Manual, Geokon, Inc., Lebanon, NH, 1990.
3. QAIP 12-1, "Measuring and Test Equipment Control"
4. QAIP 17-1, "Protecting, Preparing, and Submitting YMP QA Records"
5. QAIP 17-2, "Participant Data Archive"